

LONG TERM STABILITY OF Hg⁺ TRAPPED ION FREQUENCY STANDARDS*

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Frequency standards based on trapped ions have fundamental advantages over more established standards for long averaging times. Recently we reported the development of a Hg⁺ based frequency standard using a Linear Ion Trap (LIT) which has been used to steer three different local oscillators, a quartz crystal, H-maser, and the Superconducting Cavity Maser Oscillator (SCMO). In each case, measurement of the long term stability was limited by available ¹Hydrogen reference masers. The environmental sensitivity of the ¹Hg⁺ standard has now been measured and indicates substantial improvement in long term performance should be possible.

We report the development of a second Linear Ion Trap (LIT-2) to provide a capability for measuring the stability of the Hg⁺ based frequency standard. This second standard introduces a higher degree of thermal regulation and shows improved reliability. Increased signal from a second light collection system together with our previously demonstrated atomic line Q > 2x 10¹² is expected to yield a performance of better than $\sim 10^{-14}/\tau^{1/2}$.

The first frequency standard (LIT-1) has also been upgraded. Improvements incorporated into both standards and current stability measurements will be reported.

*This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.